We claim:

1. A method of generating ultrashort optical pulses having increased optical power, comprising the steps of:

   generating optical pulses from a source;

   stretching duration of each of the optical pulses to be greater than energy storage time of an optical amplifier;

   amplifying the stretched optical pulse with the optical amplifier; and

   compressing the optical pulse, wherein optical power of the compressed optical pulse is increased.

2. The method of claim 1, wherein the increased optical power is increased at least approximately 100 times.

3. The method of claim 1, wherein the optical pulses include: chirped pulses.

4. The method of claim 3, wherein the chirped pulses include: linear chirped pulses.

5. The method of claim 1, wherein the method step includes the step of: providing a mode locked laser source.

6. The method of claim 5, wherein the mode locked laser source includes: a gain-flattened mode-locked laser source.

7. The method of claim 1, wherein the optical amplifier includes: a semiconductor optical amplifier.

8. The method of claim 7, wherein the semiconductor optical amplifier includes a grating coupled surface emitting optical amplifier.

9. A method of increasing power in optical pulses, comprising the steps of:

generating optical pulses from a source;

increasing the temporal duration of the optical pulses to be greater than the storage time of an amplifying medium connected to the optical pulses; and

amplifying the optical pulses by the amplifying medium, wherein power in the generated optical pulses in substantially increased.

10. The method of claim 9, wherein the optical pulses are chirped pulses.

11. The method of claim 10, wherein the chirped pulses are linear chirped pulses.

12. The method of claim 9, wherein the generating step includes the step of: providing a mode locked laser source.

13. An extreme chirped pulse amplifier (XCPA), comprising:

means for generating optical pulses;

means for stretching temporal duration of the optical pulses to be greater than storage time of an amplifying medium;

means for amplifying the stretched optical pulses; and

means for compressing the stretched optical pulse, wherein higher power optical pulses are generated.

14. The laser of claim 13, wherein the generating means includes: a mode locked laser source.

15. The laser of claim 14, wherein the generating means includes: a gain-flattened mode-locked laser source.

16. The laser of claim 13, wherein the stretching means includes: a chirped fiber Bragg grating.

17. The laser of claim 13, wherein the compressing means includes: a chirped fiber Bragg grating.

18. A method of generating a highly precise high frequency timing signal, comprising the steps of:

generating optical pulses from a source;

stretching duration of each of the optical pulses to be greater than energy storage time of an optical amplifier;

amplifying the stretched optical pulse with the optical amplifier;

compressing the optical pulse; and

coupling the optical pulse to an output, wherein the optical pulse is provided as a timing signal.

19. The method of claim 18, wherein the optical pulses include: linear chirped pulses.

20. The method of claim 18, wherein the method step includes the step of: providing a gain-flattened mode locked laser source.

21. An extreme chirped pulse amplification (XCPA) laser oscillator, comprising:

a means for generating optical pulses;

means for stretching temporal duration of the optical pulses to be greater than storage time of an amplifying medium;

means for amplifying the stretched optical pulses

means for compressing the stretched optical pulses; and

means for coupling optical pulses to an output, wherein high frequency high precision optical pulses are provided.

22. The laser of claim 21, wherein the generating means includes: a gain-flattened mode-locked laser source.

23. The laser of claim 21, wherein the stretching means includes:

a chirped fiber Bragg grating.

24. The laser of claim 21, wherein the compressing means includes: a chirped fiber Bragg grating.

25. A method of generating ultrashort optical pulses having increased optical power, comprising the steps of:

generating optical pulses with high optical energy and a linear chirp;

stretching the duration of each optical pulse to be greater than the energy storage time of an optical amplifier;

amplifying the stretched optical pulse with said optical amplifier;

compressing the optical pulse, wherein the optical power of compressed optical pulse is increased.

26. The method of claim 25, wherein the method step includes modulating the optical pulse whereby the optical pulse is further shortened.

27. The method of claim 26, wherein the modulating step comprises an active modulator such as a LiNbO3 modulator.

28. The method of claim 26, wherein the modulating step comprises a passive modulator such as a multiple quantum well saturable absorber.

29. The method of claim 25, wherein the method step includes the step of: routing the compressed optical pulse back to the generating step.

30. The method of claim 29, wherein the method step includes the step of: output coupling the compressed optical pulse.

31. The method of claim 30, wherein the output coupling includes a: fiber coupler.

32. An extreme chirped pulse amplifier (XCPA) laser, comprising:

means for generating optical pulses;

means for stretching temporal duration of the optical pulses to be greater than storage time of an amplifying medium;

means for compressing the stretched optical pulses; and

means for amplifying the compressed optical pulses, wherein higher power optical pulses are generated.

33. The laser of claim 32, wherein the generating means includes: a mode locked laser source.

34. The laser of claim 33, wherein the generating means includes: a gain-flattened mode-locked laser source.

35. The laser of claim 32, wherein the stretching means includes: a chirped fiber Bragg grating.

36. The laser of claim 32, wherein the compressing means includes: a dual pass grating compressor.

37. The laser of claim 32, further comprising a means for modulating the optical pulse wherein the pulse is further shortened.

38. The laser of claim 37, wherein the modulating means includes: an active modulator such as a LiNbO3 modulator.

39. The laser of claim 37, wherein the modulating means includes: a passive modulator such as a multiple quantum well saturable absorber.

40. A method of generating an extreme chirped pulse amplification (XCPA) effect in an oscillator, comprising the steps of:

generating optical pulses from an oscillator;

stretching temporal duration of the optical pulses to be greater than storage time of an amplifying medium;

compressing the stretched optical pulses;

amplifying the compressed optical pulses; and

outputting high frequency high precision optical pulses from the amplified pulses.